

## Abstracts of Technical Articles from Bell System Sources

*Paper as a Medium for Analytical Reactions.*<sup>1</sup> B. L. CLARKE and H. W. HERMANCE. Absorbent paper has long been used in chemical laboratories for filtering suspensions. Paper has also found a special use as a container or holder for certain testing reagents; litmus paper is a common example. In this article and a preceding one (*Indus. & Engg. Chem., Anal. Ed.*, June 15, 1937), are reported exploratory investigations on the extension of the use of absorbent papers in chemical analysis.

Rapid identification "spot tests" have been described by Feigl in which, by successively placing drops of unknown and reagent solutions on filter paper, characteristic color changes are produced. Methods and apparatus are described in the present articles whereby some of the variables in such tests are controlled. Chief among these innovations is the use of semi-soluble instead of soluble reagents, and the precipitation of these compounds directly on the paper fibres to form a more or less permanent test paper. By these changes in technique the sensitivity—the smallest amount of a given metal detectable—is decreased from ten to one-hundredfold. For example, 0.002 microgram of copper can be detected by the new method, as compared with 0.2 by the old.

In another application a very dilute solution of some metal ion is slowly siphoned through a small circular piece of reagent paper suitably mounted. The metal is entrapped on the paper in an insoluble form strongly adsorbed by the paper. Theoretical analysis indicates that copper, for example, may be removed from a solution in this way so completely that only  $8 \times 10^{-12}$  microgram will be left in a liter.

*Neutral Particles in Physics.*<sup>2</sup> KARL K. DARROW. During the early days of science, the elementary particles which scientists and philosophers alike saw fit to postulate were always imagined as chargeless. With the remarkable growth of the understanding of electricity during the nineteenth century, and with the invention of instruments for detecting small charged particles during the twentieth, it became the custom to suppose that the fundamental particles of

<sup>1</sup> *Indus. & Engg. Chem., Anal. Ed.*, October 15, 1938.

<sup>2</sup> *Amer. Phil. Soc. Proc.*, September 30, 1938.

matter all bear charges and that the forces exhibited in Nature are all electrical (exception being made for gravitation). A noted and serious objection to this view was temporarily met by the adoption of quantum mechanics. Since 1930 a reversal of trend has set in, heralded by the discovery of the neutron as a subatomic chargeless particle capable of independent existence; and at present there is a strong tendency to develop the view that neutral as well as charged particles of subatomic size, and non-electrical as well as electrical forces, exist together in Nature.

*Electrical Networks for Sound Recording.*<sup>3</sup> F. L. HOPPER. Electrical networks are employed in sound recording for modifying and limiting the frequency-response characteristic. The necessity for their use, application, and design is described. Particular emphasis is placed upon the constant-resistance type of structure.

*Sound Pictures in Auditory Perspective.*<sup>4</sup> FRANKLIN L. HUNT. Soon after sound reproduction in auditory perspective was demonstrated over telephone circuits between Philadelphia and Washington in 1933, experimental sound pictures in auditory perspective were made at the Bell Telephone Laboratories' sound picture laboratory. Listening tests showed that they distinctly enhanced the illusion that the sound originated at its apparent source on the screen and they strikingly improved the feeling of spaciousness and reality. The auditory perspective effect is not primarily dependent upon perfect synchronism of the two sound-tracks required, nor on frequencies above the present commercial range. Existing equipment can be converted to project sound pictures in auditory perspective without great difficulty.

*Composition and Colloidal Properties of Balata Latex.*<sup>5</sup> A. R. KEMP. This paper reports the composition and colloidal properties of two types of balata latex from Dutch Guiana. The white variety is shown to be superior to the red, owing to its higher content of hydrocarbon.

It is shown that balata latex is very stable owing to the presence of a highly protective water-soluble substance in its serum. It cannot be coagulated by acids or salts, but is readily coagulated by alcohol or acetone.

The balata latex particles are spherical and vary in diameter from about 0.1 to 2.5 microns with an average diameter of about 0.5 micron.

The balata latex particles are shown to enclose the resins, which

<sup>3</sup> *Jour. S. M. P. E.*, November 1938.

<sup>4</sup> *Jour. S. M. P. E.*, October 1938.

<sup>5</sup> *India Rubber World*, December 1, 1938.

appear to be present in a dispersed state in the hydrocarbon. The particles are shown to contain about 18% of water, determined as water of retention in pressed coagulum.

The "resins" have been separated from both types of balata latex as water-white viscous liquids which deposit crystals of  $\beta$ -amyirin acetate on standing. The red balata latex resin is shown to be more viscous than the white and to differ from it as regards its iodine value, refractive index, and solubility in cold 95% ethyl alcohol.

The serum constituents have been separated into four main fractions: protein, carbohydrate, gummy substance, and ash. Minor constituents such as tannin and amino-acid have also been noted.

A complete analysis of balata ash has been made and compared with the analysis of ash from *Hevea* latex by Bruce. Balata ash was found to contain higher contents of  $\text{CaO}$ ,  $\text{Na}_2\text{O}$ , and  $\text{MgO}$  and lower contents of  $\text{K}_2\text{O}$  and  $\text{P}_2\text{O}_5$  than *Hevea* latex ash.

New data are presented on the density, refractive index, dielectric constant, and heat of combustion of balata hydrocarbon which are believed to be more reliable than similar data previously available in the literature. Data on the effect of temperature on the refractive index of balata and gutta percha hydrocarbon are presented, showing the crystallization of the gutta hydrocarbon on cooling, which starts at about 37° C. resulting in an abrupt increase in refractive index occurring between 37° and 35° C.

*A Short-Wave Single-Sideband Radio Telephone System.*<sup>6</sup> A. A. OSWALD. There is described briefly a short-wave single-sideband system which has been developed for transoceanic radio telephone service. The system involves the transmission of a reduced carrier or pilot frequency and is designed to include the testing of twin-channel operation wherein a second channel is obtained by utilizing the other sideband.

The paper indicates the reasons which led to the selection of this particular system and discusses at some length those matters which require agreement between the transmitting and receiving stations when single-sideband transmission is employed.

*The Oxide-coated Filament. The Relation between Thermionic Emission and the Content of Free Alkaline-earth Metal.*<sup>7</sup> C. H. PRESCOTT, JR. and JAMES MORRISON. The oxide-coated filament had its beginning in the sealing-wax era of vacuum technique. The obscure accident of its origin is not recorded, but all of our older physicists knew

<sup>6</sup> *Proc. I. R. E.*, December 1938.

<sup>7</sup> *Jour. Amer. Chem. Soc.*, December 1938.

that an enhanced emission of electrons could be obtained by smearing sealing-wax on a platinum ribbon and burning it off in air. The first authentic study is recorded by Wehnelt, who investigated the voltage-drop in a gas discharge tube with cathodes coated with various metallic oxides. Its further evolution and development to the status of a cathode in Western Electric vacuum tubes has been described by H. D. Arnold. A comprehensive treatment of its history, the various modifications in current use, and divergent theories of its preparation and behavior has been given by Saul Dushman in a treatise on "Thermionic Emission." A later review is given by J. H. deBoer.

The present work is devoted to a quantitative determination of the relation between thermionic emission and the content of free alkaline earth metal. To this end we have employed a filament which is a platinum rhodium core coated with barium, strontium, and nickel carbonates. On heating in a reducing atmosphere this coating becomes a grossly homogeneous colloidal mixture of barium oxide, strontium oxide, and free nickel. After a thorough preliminary clean-up of the experimental tube, the requisite amounts of free alkaline-earth metal are generated by reaction with methane. The electrical measurements are summarized by the use of the Richardson equation for thermionic emission. Free alkaline earth metal has been determined by oxidation with carbon dioxide and analysis of the gaseous reaction products.

Using a filament coated with a colloidal mixture of barium oxide, strontium oxide, finely divided nickel, and free alkaline earth metal, we have investigated the quantitative relation between thermionic emission and the content of active metal. A high level of activity was found from 15  $\mu\text{g./sq.cm.}$  to 60  $\mu\text{g./sq.cm.}$  of equivalent Ba, with a slight apparent maximum at 30  $\mu\text{g./sq.cm.}$  where the thermionic current at 1050° K. is 600 m. a./sq.cm. The electron work function is 1.37 v.

The radiant emissive power at 0.66  $\mu$  is approximately 64%, independent of the content of active metal.

The free alkaline earth metal was determined by oxidation with carbon dioxide and analysis of the gaseous reaction products.

*A Single-Sideband Receiver for Short-Wave Telephone Service.*<sup>8</sup>  
A. A. ROETKEN. A new radio telephone receiver has been developed for the reception of reduced-carrier single-sideband signals in the frequency range from 4 to 22 megacycles. This receiver employs triple detection in which the first beating oscillator is continuously

<sup>8</sup> *Proc. I. R. E.*, December 1938.

variable and the second is fixed in frequency. The first oscillator is a very stable tuned-circuit type, the proper adjustment of which is maintained through the use of an improved type of synchronizing automatic-tuning-control system. The second oscillator is crystal controlled. Separation of the carrier and sideband is accomplished in the receiver by means of band-pass crystal filters which provide extremely high selectivity. Unusually high stability and selectivity characterize the performance of the receiver.

*Dielectric Constant and Dielectric Loss of Plastics as Related to their Composition.*<sup>9</sup> W. A. YAGER. Data are presented for the frequency variation of the dielectric constant and dielectric loss factor of various plastics over a broad frequency band extending from 1 kc. to 35 mc. The extremely low loss of polystyrene compared to that of polar plastics confirms the theory that a hydrocarbon is inherently more satisfactory from a dielectric point of view. Of the several possible mechanisms of dielectric loss which might account for the high-frequency dielectric absorption observed in polar plastics, the rotation of polar units in the chain and of polar side groups appears most probable. The fact that the loss factor maxima of phenol fibers, phenol fabrics, and phenol or urea formaldehyde molding compounds containing cellulosic fillers occur at essentially the same frequency is viewed as evidence that this dielectric absorption is an intrinsic property of cellulose. Substitution of mineral fillers for cellulose reduces the high-frequency loss to that residing in the polar resin binder. Furthermore, the dielectric loss of mineral-filled molding compounds is less moisture-sensitive. The large increase in dielectric loss at low frequency always found in materials of relatively high free-ion conductivity manifests itself in Duprene, and the humidified phenolic plastics containing cellulose fillers or laminations.

<sup>9</sup> *Electrochemical Society Preprint* No. 74-24, October 12-15, 1938.